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Synthesis of Al_2O_3-SiC porous ceramics from coal ash

Beiyue Ma[1], **Yue Yin**[2], **Yaran Zhang**[3], **Chang Su**[4] and **Shiming Li**[5]
[1,3,4,5]Northeastern University, China
[2]Technische Universität Darmstadt, Germany

Coal ash is an industrial waster during the combustion of coal for energy production, which is identified as an environmental pollutant. It is necessary to find a new route which can effectively and comprehensively utilize coal ash. We reported using coal ash and activated carbon as raw materials to synthesize Al_2O_3-SiC porous ceramics by carbon reduction reaction method. Effects of silicon carbide content on phase compositions, microstructures, mechanical properties, apparent porosity, distribution of pore size, thermal diffusivity, and compressive strength of final products were investigated. Experimental results showed that Al_2O_3-SiC porous ceramics can be synthesized with the mass ratio of coal ash to activated carbon is 100:58, an addition amount of silicon carbide10wt%, and 5wt% phenolic resin as a binder at 1600 °C for 5 h. The as-synthesized Al_2O_3-SiC porous ceramics have the apparent porosity of 48.35%, the high temperature and room temperature compressive strength of 21.65MPa and17.57MPa, water absorption of 33.21%, the thermal shock resistance more than 8 times (1400°C, 6 times in air and 2 times in water), diameter shrinkage of 15.48%, bulk density of 1.05g/cm^3, thermal diffusivity of 0.0194cm2/s, and median size is about 4.24μm. The formation process of Al_2O_3-SiC porous ceramics was also discussed.

maby@smm.neu.edu.cn